U.S. Department
of Transportation

**National Highway Traffic
Safety Administration**

MOTOR VEHICLE SAFETY 1995

A Report on Activities under the National Traffic and Motor Vehicle Safety Act of 1966, and the Motor Vehicle Information and Cost Savings Act

CONTENTS

INTRODUCTION

Since the basic legislation establishing the mission administered by the National Highway Traffic Safety Administration (NHTSA) was enacted in 1966, the agency's primary mission has been to improve highway safety: to reduce the deaths, injuries, and economic losses resulting from motor vehicle crashes.

As part of the agency's Government Performance and Results Act (GPRA) pilot project, the following performance measures were established for 1995:

Overall Agency Outcome Measures:

- Reduce motor vehicle fatality, injury, and crash rates per 100 million vehicle miles traveled, and
- Reduce motor vehicle fatality and injury rates per 100 thousand population,

Intermediate Outcome Measures:

Reduce the Occurrence of Crashes

- Reduce the involvement rate of drivers in crashes as a proportion of licensed drivers,
- Reduce the rate of crashes as a proportion of registered vehicles, and
- Reduce the proportion of fatalities that are alcohol-related.

Reduce the Consequences of Crashes

- Increase the national average safety belt use rate,
- Reduce occupant fatality and injury rates per 100,000 licensed drivers, and
- Reduce preventable mortality through emergency medical services.

Customer Service

- Increase timeliness and responsiveness of the agency's service to the public.

Although traffic-related deaths increased slightly from 40,676 in 1994 to 41,798 in 1995, the fatality rate per 100 million miles traveled remained at 1.7, the lowest level in history. The injury rate per 100 million vehicle miles remained at the same level as in 1994, while the fatality and injury rates per 100,000 population increased slightly. The proportion of fatalities that are alcohol-related increased to 41.3 percent. Safety belt use remained at 67 percent.

The Nation's highway safety problems are far from solved. Deaths on our streets and highways account for more than 90 percent of all transportation fatalities. The health care and other economic costs of fatalities in motor vehicle crashes, with the attendant injuries and property damage, amount to more than $150 billion each year. For people in the first four decades of their lives, injuries resulting from motor vehicle crashes are the leading cause of death and lifelong impairment.

INJURY CONTROL

Injury is the leading cause of all deaths for persons from age 1 to 44 years, as well as the most common cause of hospitalizations for persons under age 40. The financial costs of injuries are staggering: injuries cost billions of dollars in health care and social support resources. However, injury has not received the same level of public attention and resources as have other health issues, and despite recent progress, injury remains a major public health problem. Resources must be more effectively utilized to meet the challenge posed by injuries.

In 1995, NHTSA began to implement its vision of injury control as laid out in the Strategic Plan. The agency's Draft Strategic Execution Plan (SEP), which addresses injury control through specific milestones from 1995 until 1999, was distributed for public comment. The Safe Communities concept was kicked off which will build an injury control infrastructure at the local level through partnerships of health care, business, government, and community groups. The Safe Communities focus is on assessing the most urgent injury control needs at the community level.

STRATEGIC PLANNING

The agency's first Strategic Plan was released in December 1994, and staff immediately began the important work of detailing how the agency would achieve its eleven goals. Each Associate Administrator served as a Goal Champion leading a team of employees in determining the actions necessary to achieve a particular strategic goal. The teams also developed measures of performance to quantify program and Agency effectiveness. This information was assimilated, into a Draft SEP that was distributed for public comment in October 1995.

INTERMODAL SURFACE TRANSPORTATION EFFICIENCY ACT (ISTEA)

On December 18, 1991, the President signed the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, reauthorizing NHTSA's highway safety and vehicle programs. ISTEA requires NHTSA to initiate vehicle safety rulemakings in several areas: extending dynamic side impact protection to light trucks, vans, and multipurpose vehicles; addressing rollover protection in passenger cars, light trucks, vans, and multipurpose vehicles; improving the design of safety belts; improving the braking systems of heavy trucks; amending Federal Motor Vehicle Safety Standard (FMVSS) No. 208, "Occupant Crash Protection," to require passenger cars, light trucks, and multipurpose vehicles to have full front seat air bags; exploring the need for any additional brake performance standards for passenger cars, including an antilock braking system (ABS); adopting ways to reduce head injuries in passenger cars by the vehicle's upper interior components; and addressing the safety of child booster seats used in passenger cars.

GOVERNMENT PERFORMANCE AND RESULTS ACT (GPRA) OF 1993

In August 1993, Congress enacted the GPRA to improve efficiency and effectiveness in the Federal government, by increasing the confidence of the American people in its capabilities through improvements in program results, service quality, and customer satisfaction. The Act requires strategic plans by 1997 for all agencies and performance plans beginning in FY 1999. It also established a FY 1994 through 1996 pilot program for performance measurement. NHTSA and 52 other agencies or programs within agencies were designated as pilot projects by the Office of Management and Budget (OMB). NHTSA is one of only eight pilot projects that cover an entire agency.

In March, the agency published its fiscal year (FY) 1994 Performance Report describing the agency's actual performance against the measures set forth in the FY 1994 Performance Plan. NHTSA released its FY 1996 Performance Plan in April, the third and final plan under the pilot program. The agency also included performance measures for each program in its FY 1996 budget request to Congress.

NATIONAL PERFORMANCE REVIEW (NPR)

NHTSA has been at the forefront of the Federal Government's reinvention and is often referred to as an example of how government agencies can successfully change how they do business. NHTSA's Auto Safety Hotline received NPR's Hammer Award for innovations in customer service. The agency developed a performance-based pilot for the Section 402 highway safety grant program, that relies less on Federal oversight and more on state accountability. Sixteen states chose to participate in the pilot for FY 1996. Internal agency regulations have been reduced by over 50 percent and a regulatory reform initiative identified several highway and motor vehicle safety regulations that can be eliminated or revised. Finally, NHTSA met its FY 1995 streamlining targets for reduced staffing levels while continuing to provide exceptional service to its customers.

OCCUPANT PROTECTION

Under the phase-in requirements of FMVSS No. 208, "Occupant Protection," all passenger cars built after September 1, 1989, have been equipped with automatic crash protection (e.g., air bags or automatic safety belts). The phase-in for automatic protection began for light trucks, vans, and sport utility vehicles in

model year (MY) 1995, with 20 percent of each manufacturer's production of these vehicles required to be equipped with automatic protection. Air bags increasingly are becoming the technology of choice for consumers and about 9,886,000 MY 1994 cars, light trucks, and vans were equipped with them. It is estimated that over 13,686,000 MY 1995 light passenger vehicles have air bags.

In 1995, NHTSA also published its most significant occupant protection rule (in terms of lives saved and injuries prevented to the American public) since the automatic crash protection rule was published more than a decade ago. This new rule requires significantly increased protection for a person's head during a crash. NHTSA estimates this requirement for improved head protection will prevent more than 1,400 deaths each year once it is incorporated in vehicles on the road. Other occupant crash protection efforts emphasized improved protection in frontal and side impacts, rollovers and other efforts to prevent ejections, child restraints, and school buses. .

RESEARCH AND DEVELOPMENT

Research and rulemaking efforts to improve motor vehicle safety emphasized crash avoidance and occupant protection. Crash avoidance priorities included an aggressive program to analyze the causal factors in accident causation and the development of preliminary performance guidelines for assisting drivers in avoiding several types of collisions through the use of intelligent transportation systems (ITS) technologies. Work was completed on several projects which addressed driving behavior considerations such as driver workload assessments of ITS countermeasures. A new research tool, the Data Acquisition System for Crash Avoidance Research (DASCAR) was completed. Operational tests of two safety-related systems: an Automatic Collision Notification (ACN) System and an Intelligent Cruise Control (ICC) System were initiated. Additionally, the agency conducted a thorough technical and cost evaluation of two competing National Advanced Driving Simulator (NADS) contractors' design. Based on this evaluation, TRW has been selected to carry out the NADS construction phase of the program.

In the area of occupant crash protection, efforts emphasized improved protection in frontal crashes, side impacts, rollovers, child restraints, fuel system integrity, and seating systems.

SAFETY ASSURANCE

The enforcement of Federal laws, standards, and regulations governing motor vehicles is one of NHTSA's most important safety responsibilities. By identifying safety problems in motor vehicles and ensuring that these problems are fixed through safety recalls, this program is a critical component of injury prevention. Emphasis is on quickly and accurately identifying safety-related defects and noncompliances with safety standards, and ensuring that they are corrected in the shortest possible time. There were 305 recall campaigns involving 17.8 million motor vehicles. Twenty-one percent of the 1995 recalls, representing 64 percent of the vehicles, were influenced by NHTSA investigations. The others were initiated voluntarily by the manufacturers.

STATISTICAL SUMMARIES

TABLE 1

Distribution of Traffic Fatalities For 1994 and 1995

Fatality Category	1994	1995	Percent Change 1994-1995
Occupant Fatalities			
Passenger Cars	21,997	22,358	+1.6
Light Trucks/Vans/Utility Vehicles	8,904	9,539	+7.1
Motorcycles	2,870	2,644	–4.3
Medium/Heavy Trucks	820	788	–3.9
Buses	18	32	+77.8
Other Vehicles*	317	305	-3.8
Unknown	92	175	+90.2
Total Occupant Fatalities	34,318	35,274	+2.8
Nonoccupant Fatalities			
Pedestrians	5,489	5,585	+1.7
Bicyclists	802	830	+3.5
Other Nonoccupants	107	109	+1.9
Total Nonoccupant Fatalities	6,398	6,524	+2.0
Total Fatalities	40,716	41,798	+2.7

(*) "Other Vehicles" includes motor homes, snowmobiles, farm equipment (other than trucks), ATVs, construction equipment (other than trucks), go carts, fork lifts, etc.

TABLE 2

Summary of U.S. Motor Vehicle Activities and Fatalities Calendar Years 1985 – 1995

Year	Licensed Drivers (Millions)	Registered Motor Vehicle (Millions)	Vehicle Miles Traveled (Billions)	Traffic Fatalities*	Fatality Rate**
1985	156.9	177.1	1,774	43,825	2.5
1986	159.5	181.4	1,835	46,087	2.5
1987	161.8	183.9	1,921	46,390	2.4
1988	162.9	189.0	2,026	47,087	2.3
1989	165.6	191.7	2,096	45,582	2.2
1990	167.0	192.9	2,144	44,599	2.1
1991	169.0	192.5	2,172	41,508	1.9
1992	173.1	194.4	2,247	39,250	1.7
1993	173.1	198.0	2,297	40,150	1.7
1994	175.4	192.2	2,360	40,716	1.7
1995	177.4	194.5	2,403	41,798	1.7
Percent Change 1985-1995	+13.1	+17.6	+35.5	+4.6	-32.0
Percent Change 1994-1995	+1.2	+1.2	+1.8	+2.7	+0.8

[a] Baaed on 30–day definition
** Fatalities per 100–million vehicle miles

Source: Licensed Drivers, Registered Motor Vehicles, and Vehicle Miles Traveled-FHWA

Source: Fatalities—NHTSA's Fatal Accident Reporting System (FARS)

FEDERAL MOTOR VEHICLE SAFETY STANDARDS

The following list presents the Federal Motor Vehicle Safety Standards that were in effect in 1995.

CRASH AVOIDANCE SAFETY STANDARDS

FMYSS No. 101 "Controls and Displays"

FMVSS No. 102 "Transmission Shift Level Sequence, Starter Interlock, and Transmission Braking Effect"

FMVSS No. 103 "Windshield Defrosting and Defogging Systems"

FMVSS No. 104 "Windshield Wiping and Washing Systems"

FMVSS No. 105 "Hydraulic Brake Systems"

FMVSS No. 106 "Brake Hoses"

FMVSS No. 107 "Reflecting Surfaces"

FMVSS No. 108 "Lamps, Reflective Devices, and Associated Equipment"

FMYSS No. 109 "New Pneumatic Tires"

FMVSS No. 110 "Tire Selection and Rims"

FMYSS No. 111 "Rearview Mirrors"

FMYSS No. 112 "Headlamp Concealment Devices"

FMVSS No. 113 "Hood Latch System"

FMVSS No. 114 "Theft Protection"

FMVSS No. 115 "Vehicle Identification Number-Basic Requirements"

FMVSS No. 116 "Motor Vehicle Brake Fluids"

FMVSS No. 117 "Retreaded Pneumatic Tires"

FMVSS No. 118 "Power-Operated Window Systems"

FMVSS No. 119 "New Pneumatic Tires for Vehicles Other Than Passenger Cars"

FMVSS No. 120 "Tire Selection and Rims for Motor Vehicles Other Than Passenger Cars"

FMVSS No. 121 "Air Brake Systems"

FMVSS No. 122 "Motorcycle Brake Systems"

FMVSS No. 123 "Motorcycle Controls and Displays"

FMVSS No. 124 "Accelerator Control Systems"

FMVSS No. 125 "Warning Devices"

FMVSS No. 126 "Truck-Camper Loading"

FMYSS No. 129 "New Non-pneumatic Tires for Passenger Cars"

FMVSS No. 131 "School Bus Pedestrian Safety Devices"

FMVSS No. 135 "Passenger Car Brake Systems"

CRASHWORTHINESS SAFETY STANDARDS

FMVSS No. 201 "Occupant Protection in Interior Impact"

FMVSS No. 202 "Head Restraints"

FMVSS No. 203 "Impact Protection for the Driver from the Steering Control System"

FMVSS No. 204 "Steering Control Rearward Displacement"

FMVSS No. 205 "Glazing Materials"

FMVSS No. 206 "Door Locks and Door Retention Components"

FMVSS No. 207 "Seating Systems"

FMVSS No. 208 "Occupant Crash Protection"

FMVSS No. 209 "Seat Belt Assemblies"

FMYSS No. 210 "Seat Belt Assembly Anchorages"

FMS'SS No. 211 Wheel Nuts, Wheel Discs, and Hub Caps"

FMVSS No. 212 "Windshield Mounting"

FMVSS No. 213 "Child Restraint Systems"

FMYSS No. 214 "Side Impact Protection"

FMVSS No. 216 "Roof Crush Resistance-Passenger Cars"

FMVSS No. 217 "Bus Window Retention and Release"

FMVSS No. 218 "Motorcycle Helmets"

FMS'SS No. 219 "Windshield Zone Intrusion"

FMVSS No. 220 "School Bus Rollover Protection"

FMVSS No. 221 "School Bus Body Joint Strength"

FMVSS No. 222 "School Bus Passenger Seating and Crash Protection"

FMVSS No. 301 "Fuel System Integrity"

FMYSS No. 302 "Flammability of Interior Materials"

FMVSS No. 303 "Fuel System Integrity of Compressed Natural Gas Vehicles"

FMVSS No. 304 "Compressed Natural Gas Fuel Container Integrity"

HEAD IMPACT PROTECTION

NHTSA published a rule that will require significantly increased protection for a person's head during a crash. This rule offers the greatest safety benefits of any regulation NHTSA has published in more than a decade. The agency estimates this requirement for improved head protection will prevent more than 1,400 deaths each year once it is incorporated in vehicles on the road.

OCCUPANT CRASH PROTECTION

The agency's research indicates that rear-facing infant restraints should not be placed in the front seat of a vehicle equipped with a passenger-side air bag. This poses a problem for passenger cars and light trucks that are equipped with a passenger-side air bag and whose rear seats cannot accommodate a rear-facing infant restraint. NHTSA published a final rule in 1995 to permit manufacturers to install a manual device motorists could use to deactivate the front passenger-side air bag in these vehicles so rear-facing infant restraints can be placed safely in the front seat.

SIDE IMPACT PROTECTION

NHTSA published a final rule extending the dynamic side impact rulemaking (FMVSS No. 214) requirements for passenger cars to light trucks and vans and small buses.

REAR DOOR LOCK STRENGTH

NHTSA published a rule extending the side door lock and latch strength requirements to the rear doors of cars, vans, and sport utility vehicles. The door lock requirements will now apply for the first time to the rear doors in hatchbacks, station wagons, sport utility vehicles, and passenger vans.

PASSENGER CAR BRAKES

NHTSA published a rule that will replace the current passenger car braking standards with a new internationally harmonized braking standard.

HEAVY TRUCK BRAKES

NHTSA published a rule that will require heavy trucks, trailers, and buses to be equipped with antilock brakes. This rule also established maximum stopping distance requirements for these vehicles.

CHILD SAFETY

As part of its ongoing effort to improve child passenger safety, NHTSA published a rule adding additional sizes and weights for the test dummies used to assess child restraints. These new dummies enable NHTSA to look more carefully at the protection offered to children ranging from newborn infants to age 6.

NEGOTIATED RULEMAKING ON LIGHTING REQUIREMENTS

A negotiated rulemaking was initiated on headlamp aim. The goal of this effort is to bring together all interested parties to produce better headlamp aim on the road for the American public by simplifying the existing procedures for aim, while ensuring that the aim provisions do not impose any needless barriers to international harmonization. Groups involved in this negotiation are representatives of vehicle and headlamp manufacturers, dealers, repair shops, state inspection stations and state highway departments, European and Japanese manufacturing groups, and public interest groups.

OBSERVANCE OF FEDERAL MOTOR VEHICLE SAFETY LAWS, STANDARDS, AND REGULATIONS

NHTSA is responsible for enforcing Federal motor vehicle safety laws, standards, and regulations. Actions taken in this area include:

- In 1995 there were 305 safety defect and safety standards noncompliance recall campaigns involving 1'7.8 million vehicles. Fifty-three of these campaigns, involving 11.4 million vehicles, were influenced by NHTSA investigations. Of the 305 recalls, 258 involved vehicles (17.8 million vehicles), 44 involved equipment (800,000 items of equipment) and 3 involved tires (9500 tires). The chart below summarizes the 1995 safety recalls.

- Ninety seven motor vehicles and 3,609 items of equipment were tested for compliance with the requirements of the Federal motor vehicle safety standards and the bumper regulation (Part 581).

- NHTSA's Auto Safety Hotline received more than 809,000 calls and mailed over 200,000 publications to consumers. The publications consisted of vehicle recalls summaries, tire reports, questionnaires for reporting defects, child safety seat recall summary reports, New Car Assessment Program reports, child safety seat registration forms, and pamphlets or reports on other topics.

		Safety Related Defect		Noncompliance with FMVSS	
		Manufacturer	NHTSA Influenced.	Manufacturer Influenced.	NHTSA
Vehicles	Recalls	151	51	54	2
	Population	3,609,963	11,397,899	2,793,357	5,206
Equipment	Recalls	27	6	5	6
	Population	508,839	18,326	233,498	48,714
Tires	Recalls	1	0	2	0
	Population	2,016	0	7,511	0

- In addition to the 1995 recall total, which was the largest in history, more than 6.3 million vehicles were involved in NHTSA-influenced service campaigns to improve the safety of the vehicles.

- There were 95 defect investigations initiated in 1995. Of these, more than 75 percent were initiated by calls to the agency's Auto Safety Hotline.

- A total of 16 noncompliance investigations were opened, 8 were completed and forwarded to the Office of the Chief Counsel for consideration of legal action, and 33 investigations were closed.

- Twenty-six odometer fraud investigations involving 1,342 vehicles were conducted in 14 states. Twenty-one cases involving large-scale odometer tampering were turned over to the U.S. Department of Justice for criminal prosecution, and 3 cases were referred to state enforcement agencies. NHTSA supported 13 Federal grand jury odometer fraud investigations that resulted in 21 criminal convictions. Prison sentences ranged from 5 months to 65 months.

- The number of nonconforming vehicles (vehicles which are not certified to comply with applicable safety standards) imported

into the United States increased from 14,173 in 1994 to 15,332 in 1995. These vehicles were monitored to ensure that, where required, nonconforming vehicles were brought into compliance.

- Administrative enforcement actions under Chapter 301, Motor Vehicle Safety, 49 United States Code, Section 30165, resulted in 12 civil penalties, totaling $136,000.

- The Environmental Protection Agency (EPA) reported to NHTSA the corporate average fuel economy (CAFE) performance of 9 passenger car and 4 light truck fleets (9 vehicle manufacturers) during calendar year 1995. When the CAFE of a manufacturer falls below the minimum required, NHTSA sends the manufacturer either a letter allocating previous MY credits to offset the shortfall, or a shortfall notification letter.

- A penalty of $50 was collected from 1 manufacturer for MY 1990, a penalty of $50 was collected from 1 manufacturer for MY 1991, a penalty of $50 was collected from 1 manufacturer for MY 1992, penalties of $8,524,430 were collected from 3 manufacturers for MY 1993, and a penalty of $387,375 was collected from 1 manufacturer for MY 1994. Penalties totaled $8,911,955 for calendar year 1995.

SUMMARY OF CURRENT RESEARCH PROJECTS, GRANTS, AND CONTRACTS

The following is a summary of current research projects, grants, and contracts conducted by NHTSA:

NATIONAL CENTER FOR STATISTICS AND ANALYSIS (NCSA)

NHTSA's National Center for Statistics and Analysis develops and operates a variety of data collection and analysis programs to support the agency's safety activities. Major databases operated by the Center include:

- **National Accident Sampling System (NASS)-Crashworthiness Data System.** A nationally representative sample of about 5,000 motor vehicle crashes is investigated annually by teams of trained investigators. Data from these investigations are used to support research and rulemaking to improve vehicle crashworthiness and occupant protection.

- **NASS-General Estimates System (GES).** GES is a nationally representative sample of about **50,000** crashes. Information is extracted directly from police accident reports and used to make national estimates of the extent and characteristics of police-reported crashes.

- **Fatal Accident Reporting System (FARS).** FARS is a census of police-reported crashes occurring on a public road in which at least one participant is fatally injured and dies within 30 days of the accident. Data are used to monitor trends in the frequencies and characteristics of fatal crashes, and to support crashworthiness and crash avoidance research and rulemaking.

Other sources of crash data used by the Center include:

- Special investigations performed by trained investigators in which some crashes of special interest are investigated in detail.

- Police-reported accident data provided by some states that are used to identify research requirements and evaluate highway safety issues. The large number of crashes and vehicles involved permit vehicle-related analyses by make and model.

Analyses of the Center's data included:

- Estimates of the number of lives saved by safety belt laws, child restraints, motorcycle helmets, and minimum drinking age laws.

- The role of alcohol in fatal motor vehicle crashes.

- Annual reports for the FARS and GES.

- Monthly trends in fatal crashes.

- Analyses to support enforcement issues in the areas of potential defect investigation and compliance testing.

Technical Reports published included:

- Safety Belt Use Laws: Evaluation of Primary Enforcement and Other Provisions, DOT-HS-808324, and associated Research Note, October 1995.

- Crash Data and Rates for Age-Sex Groups of Drivers, 1994, Research Note, October 1995.

- Revised Vehicle Miles of Travel for Passenger Cars and bight Trucks, 1975 to 1993, Research Note, September 1995.

- National Accident Sampling System Crashworthiness Data System, 1991-1993, DOT-HS-808-298, August 1995.

- National Occupant Protection Use Survey – Controlled Intersection Study, Research Note, May 1995.

- National Occupant Protection Use Survey – Shopping Center Study, Research Note, May 1995.

- Estimating Lives Saved by Restraint Use in Potentially Fatal Crashes, Research Note, June 1995.

- An Analysis of the Crash Experience of Passenger Cars Equipped with Antilock Braking Systems, DOT-HS-808279, May 1995 and An Analysis of the Crash Experience of Light Trucks Equipped with Antilock Braking Systems, and associated NHTSA Research Note, June 1995.

- Registered Passenger Cars and Light Trucks, DOT-HS-808-235, February 1995.

- National Occupant Protection Use Survey — Observed Safety Belt Use in 1994 in the Moving Traffic Study, Research Note, February 1995.

- Preliminary Assessment of the Impact of Lowering the Illegal BAC Per Se Limit to 0.08, DOT-HS-808-207, December 1994; and associated NHTSA Research Note, February 1995.

- Crash, Injury, and Fatality Rates by Time of Day and Day of Week, DOT-HS-808194, January 1995.

CRASHWORTHINESS

Safety Systems

- **Door Latch Integrity Study (VRTC-86-0392).** Occupant ejection through side doors accounts for a significant number of severe injuries and fatalities. Studies of accident cases suggest that latches are frequently submitted to both lateral and longitudinal loads in crashes. Crash testing was conducted to measure these loads so that comparisons can be made with the results from component level tests. Component test procedures have been developed for evaluating door latch mechanism misalignments and door openings, the strength of latches as they are mounted in the doors, and latch system resistance to inertial loading. Also, an auxiliary latch was designed and tested to evaluate the effectiveness of this concept in reducing door openings. A new procedure is currently being examined which involves testing the door latch/striker system using a procedure similar to the existing static crush test of FMVSS No. 214, except that the loading is outward relative to the vehicle. Plans are also being formulated to investigate the possibility of modifying FMVSS No. 206 to include tests of sliding door mounting systems.

- **Child Safety Research (VRTC-82-0236).** Research has been conducted to evaluate problems of incompatibility when installing child restraints in automobiles and commercial aircrafts. Preliminary dynamic evaluation of a universal attachment system has been conducted, with an in-depth evaluation planned to support possible rulemaking action by NHTSA to allow the system's usage under FMVSS No. 213. Research was also conducted to evaluate the effect of forward-mounted safety belt anchorages, and to identify means of reducing the negative effects these types of belt systems have on the performance of some child restraints. A database for identifying which child restraints can be properly installed in which vehicle seating positions was initiated, and a PC-based "user friendly" program to access the database has been developed. Upon completion of the pilot study to finalize the "fit/not fit" criteria, collection of the data for 1995-1996 model year vehicles will begin.

- **Evaluation of Child Restraint Systems in a Commercial Aircraft Environment (VRTC-82-0236).** Research on the protective capabilities of child restraint systems when installed in a simulated commercial aircraft was conducted. Information from these tests will be used in the potential upgrade of FMVSS No. 213 to require a dynamic test for child restraints to be certified for aircraft usage. Currently, a static rollover test is the sole requirement for aircraft usage certification.

- **Frontal Crash Protection (DTRS57-95-c-00009).** Research has continued to determine the appropriate crash condition(s) for upgrading FMVSS No. 208. Testing has been conducted to evaluate the performance of air-bag-equipped occupants in frontal oblique, offset car-to-car

crashes. Testing has been conducted with a moving deformable barrier to simulate this condition. The effects of car size, impact angle, and percentage. of vehicle engagement (overlap) are being evaluated from these tests.

- **Fuel System Integrity (DTRS57-95-C-00009).** Baseline crash testing was continued to investigate possible crash scenarios that may require the upgrade of fuel system integrity (FMVSS No. 301). The focus of the activity was on crash tests configured to involve partial interlock of the vehicle with the struck vehicle's rear structure. Bumper mismatch in these collisions also was investigated.

- **Upgrade Occupant Protection Systems.** Research has continued for investigating advanced restraint system concepts. The major thrust of the activity was focused on investigating the feasibility of using radar sensors to anticipate the occurrence of a pending crash. These sensors also are being evaluated for their ability to determine collision speed and direction. Part of the longer term activity with these sensors has focused on evaluating their ability to distinguish the impacting object. Work in this area also included evaluating the effects of restraint systems on pregnant women. Toward this end, sled tests were conducted using the 5th-percentile Hybrid III dummy equipped with a "fetal" insert.

- **Improved Glazing for Reducing Ejection (VRTC-82-0252).** Research is evaluating the feasibility of requiring ejection mitigating glazings to be installed in light vehicles. This includes developing certification test procedures to evaluate the glazings' ability to retain an occupant in a crash while limiting head, neck, and laceration injuries. Both computer modeling and physical testing are being used in this effort. It also includes determining the effectiveness, costs, and benefits of various alternative glazing systems. Preliminary test procedures and cost/benefit estimates were documented in a status report and presented at a public meeting on this issue.

- **Air Bag Performance Evaluation (VRTC-86-0396).** Air bags are designed to cushion impact after they are inflated; but, in some situations occupants are too close to the air bag module and can be injured during deployment of the air bag. Driver and passenger side air bag systems are being tested with child and adult dummies in close proximity to the air bag deployment to understand the potential for serious to fatal injury in these situations. Countermeasures, such as less aggressive air bag system designs, are also being investigated to assess their potential for reducing the injuries and fatalities to occupants in close proximity to the air bag deployment.

- **Side Impact Protection (DTFH61-92-C-00128, DTNH22-92-D-07323, DTRS-57-93-D-00027, and HS 976).** Research is being conducted to provide the technical foundation for improved side impact protection. Joint efforts with the Federal Highway Administration (FHWA) to perform accident analyses and perform side impact tests using a pole have been initiated (DTFH61-92-C-00128). Detailed analytical models of a vehicle (DTNH22-92-D-07323) and the side impact dummy (DTRS-57-93-D-00027) are being developed. Analytical vehicle models are also being developed directly from crash test data for use in assessing occupant injury and investigating possible countermeasures (HS-976).

- **Crash Test Instrumentation and Data Analyses.** An upgraded system with current state-of-the-art hardware to determine the accuracy of data acquisition equipment at crash test facilities is under development (HS-976). A procedure to evaluate the quality of high-speed crash film data and recording equipment, including resolution and distortion, was developed (DTNH22-93-C-07027). Work is underway to develop advanced video analysis to digitize crash film data for tracking occupant and vehicle motions and interactions (DTNH22-93-C-07010). Research and testing was initiated to investigate generic specification for dummy based accelerometers in the agency test procedures (VRTC-83-0303).

- **Analytical Modeling for Computer Crash Simulation.** A new technique to extract analytical vehicle models directly from crash test data is continuing to be developed (DTNH22-92-D-07064). The technique was applied to develop frontal offset crash models (HS-97). As a joint effort with the Department of Energy, work is underway to develop advanced models to better characterize the vehicle interior in a crash. This will improve the accuracy of our computer simulations for studying occupant injury (DTNH22-93-X-07226).

- **Precrash Sensing.** A study is underway to investigate the feasibility of a vehicle based system with an active sensor that would activate an air bag in anticipation of a crash, but before physical contact occurs between the vehicle and the target with which it collides (DTNH22-95-X-07286).

- **Electric Vehicle Research (VRTC-83-***0286).* A research program is continuing to determine problems electric vehicles may encounter in complying with existing crashworthiness standards and to identify potentially unique safety hazards that may require implementation of new standards. Also, through participation in the Advanced Research Projects Agency (ARPA) development program, NHTSA's research staff assesses and advises on the safety issues that must be considered by the developers and manufacturers of electric vehicles.

- **Accident Data Analysis - Identification and Evaluation of Safety Problems and Related Countermeasures to Mitigate Injuries (DTNH22-93-D-**07254). NHTSA's accident and state files are utilized to address specific factors relating to crashworthiness research programs. Pro-jects place a special emphasis on establishing a scientific, engineering, and technical information base for determining and demonstrating the capability of upgrading motor vehicle structures and systems to reduce the fatalities and serious injuries caused by motor vehicle accidents. Projects also assist in identifying new safety problems, identifying countermeasures to mitigate injuries, identifying laboratory test procedures and projecting benefits for proposed countermeasures.

Biomechanics

- **Biomechanical Tests by the University of Virginia (DTNH22-93-Y-07028). The** University of Virginia has an Impact Trauma Laboratory that is investigating the response and trauma tolerance of the thorax/abdomen and the lower extremities in frontal impact.

- **Biomechanical Tests by the Medical College of Wisconsin (DTNH22-93-Y-17028).** This program investigates the injury mechanisms of the human neck under conditions where there is no head impact. This correlates to the type of loading seen by restrained occupants in crashes. Beyond the neck study, Wisconsin is tiding out the tolerance of the hip to impact, the response of the abdomen, and the biomechanics of side impact.

- **Biomechanical Tests by The Ohio State University (DTNH22-92-D-08002).** A study to develop a methodology for prediction of specific organ injuries due to side impact abdominal loading is being conducted. Work is also underway to provide an enhanced understanding of the response and biomechanics associated with whole body side impact loading.

- **Biomechanical Tests by Duke University (DTNH22-94-Y-07133).** This program investigates neck injury mechanisms when a head impact occurs. Experimental results will provide excellent insight into the interaction of an occupant with the upper interior structures of the vehicle.

- **Human Response Study by the University of Pennsylvania (DTNH22-94-H-17133).** This new Impact Trauma Laboratory is studying the susceptibility to injury of the human body during violent side impact. The University of

Pennsylvania also documents the change in shape of the human torso when it receives a violent blow to the side.

- **Biomechanical Modeling at Lawrence Livermore National Laboratory (DTNH22-94-X-07417).** Expertise will be used to enhance the abilities of current analytical software to model the human anatomy. New models will be developed to characterize the various tissues found in the human body. These new materials will be used in the development of a model of the pelvis and lower extremities.

- **Head Modelling (PA-876(11)).** A new technique for applying actual dummy test accelerations to the computational model of the head has been checked and evaluated. The program and the model will be disseminated to the Crashworthiness and Biomechanics research communities including the auto industry as they expressed interest in applying this procedure.

- **Skull Fracture Research (DTNH22-93-X-07190).** Mathematical models of the human skull have been produced directly from medical imaging data These models are currently undergoing evaluation against experimental data to assure the accuracy of their output. This evaluation is being conducted through the use of a new technique to measure the distribution of force over the skull during an impact and the changes of the distribution of force over time. This work is being conducted in collaboration with the United States Army Medical Research Command.

- **Lower Extremities Modelling (DTNH22-92-X-07415).** This project is aimed at producing a three dimensional mathematical model of the human ankle as a first step to address lower extremities' injuries. In concert with other lower extremities' research, the results from this project are expected to aid in the understanding of the mechanisms of lower extremities' injuries under automotive crash impact loadings.

- **Development of an Advanced Frontal Test Dummy (DTNH22-94-C-07010).** This program continues the development and integration of new head, face, neck, thorax, spine, abdomen, pelvis, and lower extremity frontal dummy components. Delivery of a fully integrated prototype is planned in 1996.

CRASH AVOIDANCE

- **Quantitative Characterization of Vehicle Motion Environment (DTNH22-92-Y-07319).** This is a cooperative agreement to develop a system of gathering information about actions that drivers take in normal driving. Sensors, used in conjunction with computer processing, obtain information on the paths of vehicles in their field of view. These data will determine vehicle location and speeds during maneuvers such as lane changes, crossing an intersection, and staying in the lane on curves.

- **Evaluation of the Safety Impact of the TravelAid Operational Test near Seattle, Washington (DTNH22-92-X-**07482). The TravelAid Operational Test will utilize variable message signs and in-vehicle units to advise drivers of the presence of hazards such as snow plows, icy conditions, and traffic incidents in the roadway ahead of them. The evaluation will include analysis of changes in collision rates and a study of factors, such as distraction, that might increase the risk of a collision.

- **Vehicle-Based Drowsiness Detection (DTNH22-91-Y-07266).** Work continued to identify driver performance measures that would indicate drowsiness and develop and test vehicle-based monitors of driver alertness during simulated highway driving. Vehicle-based measures under consideration include steering wheel movement, accelerator movement, driver in-seat movement, and lane position. Information obtained will be used to determine whether to activate a warning signal.

- **Human Factors Considerations of Crash Avoidance Warning Systems (DTNH22-91-C-07004).** Research **continued** to develop guidelines for systems that would warn the driver of a potential collision. They will be based on studies of how warning system design parameters, such as presentation mode, false alarm rate, message content, and location in the vehicle, influence the performance of drivers.

- **Heavy Truck Aggressivity Reduction (VRTC).** Full-scale crash testing and modeling of modified truck front-end designs is continuing to determine if the front-end of trucks can be modified to reduce the risk to occupants of smaller vehicles when the two vehicle types are involved in collisions. The effort identifies crash conditions that could possibly be lessened and the number of passenger vehicle occupant fatalities and injuries that could be prevented if such modifications were made.

- **Truck Tire Characterization.** Work continued on a cooperative industry and government research program to develop standardized test procedures for measuring and reporting the traction (braking and cornering) characteristics of heavy truck tires. The Society of Automotive Engineers (SAE) is performing the research and developing recommended test practices based on the research.

- Heavy **Truck Occupant Crash Protection (DTNH22-91-C-07297).** A project with SAE is ongoing to develop test procedures for evaluating occupant crash protection in heavy trucks, specifically restraint systems, steering wheels, dash panels, and cab structural integrity.

- **Heavy Vehicle ITS Communication & Powering Enhancement Systems (DTNH22-95-R-07001).** This a cooperative industry/government research program to develop, evaluate, and demonstrate a universal intelligent communications and powering link between the tractor and trailer for heavy duty commercial trucks.

- **Automatic Braking for Air-Braked Heavy Vehicles (DTNH22-94-Y-07016).** A prototype automatic braking system for heavy vehicles with air brakes is under development by Eaton Corporation under this cooperative agreement. The system uses a simulated collision warning signal to initiate automatic application of the truck's brakes to reduce stopping distances and prevent collisions. Various brake application strategies will be demonstrated with the prototype system.

- **Intelligent Dynamic Stability Enhancement for Heavy Vehicles (DTNH22-95-H-07002).** Two strategies for reducing heavy vehicle rollover will be developed into prototype commercial products, a rollover warning system to indicate to drivers the roll stability of their truck and an active differential braking system for multiple trailer combination vehicles to reduce rearward amplification-an effect that can result in rollover of the rearmost trailer.

- **Human Factors Studies of an Intelligent Cruise Control (ICC) System (DTNH22-94-H-27016).** A cooperative agreement with Ford Motor Company was initiated to evaluate the influence of ICC design parameters on driver performance.

- **NHTSA/University of Iowa Cooperative Agreement (DTNH22-93-Y-07237).** NHTSA and the University of Iowa entered into a Cooperative Agreement in March 1993 to support the development of NADS. The University of Iowa will provide NHTSA with specialized technical, administrative, and management support during the design of the system and development of NADS acquisition. Also, the University will develop computerized vehicle components (engine, steering, transmission, suspension, etc.) and incorporate them into software to be used in the NADS.

- **NADS-Phase II Construction and Installation (DTNH-22-94-C-07126).** Based on the results of the Preliminary Engineering Design competition conducted

by NHTSA in Phase I of the NADS development project, the agency awarded the Phase II contract to TRW Transportation Systems of Sunnyvale, California The $34.105 million contract requires the contractor to design, fabricate, integrate, test, and install the simulator in a dedicated facility building at the University of Iowa's Oakdale Research Park within a 39-month period. The university is providing the $5.7 million facility as part of its cost-sharing arrangement with NHTSA.

- **Run-Off-Road Crash Avoidance Using Intelligent Vehicle/Highway System (IVHS) Countermeasures (DTNH22-93-**C-07023). The project includes an investigation of collision data files to determine the actions drivers take to avoid a collision before running off the road; an assessment of the performance of available systems; studies of sensing, processing, and driver interface requirements: and the design of a test bed to study system concept and performance.

- **Vehicle Lateral Position Data Collection and Analysis (DTNH22-94-Y-37016).** The Rockwell Lane Position Measurement System is to be tested and the performance analyzed to develop specifications for a technology independent Lane Position Measurement System.

- **Development of Performance Specifications for Systems which Assist in Avoiding Collisions during Lane Change, Merging, and Backing, (Interagency Agreement No. DTNH22-*93-X- 07022* with the Air Force Logistic Command).** The project includes an investigation of collision data files to determine actions drivers take during lane changes, merging, and backing up to avoid a collision; an assessment of the performance of available systems; studies of sensing, processing, and driver interface requirements; and the design of a test bed to study system concepts and performance.

- **Characterization and Evaluation of a Prototype Forward-Looking Automotive Radar Cooperative Agreement (DTN-H22-94-Y-17016).** This project will develop an information base of radar cross-section data from measurements taken in the laboratory and a variety of freeway setting using a prototype, forward-looking automotive radar sensor.

- **NHTSA/University of Michigan Cooperative Agreement (DTNH22-94-Y-47016).** A 3-year Cooperative Agreement to foster the development, evaluation, and deployment of forward crash avoidance systems (FOCAS). The University of Michigan Transportation Research Institute's (UMTRI) primary goal is to facilitate the development of a range of sensors for commercial use and associated applications systems that supplement the forward crash avoidance performance of drivers.

- **Intersection Collision Avoidance using IVHS Countermeasures (DTNH22-R-**07024). The project includes an investigation of collision data files to determine actions drivers take to avoid a collision at an intersection; assessment of the performance requirements of prospective systems; studies of sensing, processing, and driver interface requirements; and the design of a test bed for studying system concepts and performance.

- **Support for the IVHS Innovations Deserving Exploratory Analysis (IDEA) Program of the National Academy of Science (DTNH22-93-X-**07379). This project, provides support for the IVHS- -IDEA Program to assess the feasibility of new, unproven, or untested concepts, and products.

- **IVHS Countermeasures for Rear End Collisions (DTNH22-93-C-07326).** The project includes an investigation of collision data files to determine actions drivers take to avoid a rear end collision; assessment of the performance of available systems; studies of sensing, processing, and driver interface requirements, and the design of a test bed for studying system concepts and performance.

- **Direct Monitor of Driver Eye Activity and Alertness (DTRS57-93-C-00166).** This research will develop a small low-cost device which can be attached to eye glasses to monitor driver eye blinks as an indicator of alertness. The device will be able to function as a stand-alone alertness monitor or work cooperatively with other systems that monitor the driver's alertness.

- **Portable Data Acquisition System for Crash Avoidance Research (DASCAR) (DTNH22-92-X-** 07453). NHTSA is nearing completion of DASCAR, a portable research tool that will be used to gather data on the actions of drivers in real-world driving situations. This system will permit the collection of data on how drivers and vehicles respond to various traffic situations by measuring the driver's performance and recording video of the driver and the roadway traffic situation.

- **Preliminary Investigation of the Safety Implications of Cellular Phone Use in Vehicles (DTNH22-92-D-07002/T.O.#4).** This effort will conduct a review of current information and research on the relationship between cellular phone use in vehicles and safety. The review will assist NHTSA in identifying relevant issues and provide a basis for determining whether problems exist and, if so, for estimating how extensive and serious they are.

- **Evaluate Forward Vehicle Lighting Systems (DTNH22-92-D-07001). This** program is evaluating existing and advanced technology forward illumination systems intended to enhance object detection and minimize glare, (e.g., polarized lighting), effects of headlight intensity on turn signal visibility, and the effects of glare on driver performance.

- **Intelligent Cruise Control Field Operational Test (DTNH22-94-Y-** 27016). The purpose of this agreement with UMTRI is to conduct a field operational test to evaluate improvements in (1) safety, (2) driving comfort and convenience, (3) traffic flow, and (4) consumer acceptance of ITS concepts, offered by an Intelligent Cruise Control (ICC) System. Specific objectives of the field operational test are: (1) test the ability of the vehicle to maintain safe speed and headway-distance between it and the preceding vehicle, (2) address basic safety questions, (i.e., is driving safer with ICC?, do ICC vehicles have fewer collisions?, and, if all vehicles had ICC, would there be fewer collisions and collision- related injuries?), and (3) evaluate the potential for decreasing the number and severity of rear end collisions.

- **Automotive Collision Avoidance System Development (ACASD) (DTNH 22-96-H-07162).** Refine the current technologies used to avoid rear-end, merging, backing and changing lanes through a series of directed engineering research and development activities and a focused effort to reduce the cost of key system components. Investigate existing, but unproven technologies which could be used to develop countermeasures that are necessary to address more complex collision scenarios. Investigate methods for providing effective and unambiguous driver warnings.

- **Field Operational Test of an Automated Collision Notification (ACN) System (Cooperative Agreement).** This project will test an in-vehicle system that automatically alerts Emergency Medical Services (EMS) after a crash. Such a system could significantly reduce EMS response time by directly transmitting vehicle location, crash severity data, and other relevant information.

- **Implementation of the Variable Dynamic Testbed Vehicle (DTNH22-95-X-07419).** This is an interagency agreement to design, fabricate, and test a Variable Dynamic Testbed Vehicle (VDTV) to be used as a test tool in highway safety research. The vehicle will allow researchers to study the effects of vehicle design and performance characteristics on driver performance. The vehicle will be used in the automated highway research program, the human factors research program, the intelligent transportation research program, and the National

Advanced Driving Simulator (NADS) development program. The vehicle will be a drive-by-wire design whose performance can be controlled and changed very quickly by computer input. The VDTV will provide a very efficient test tool for examining the effect of vehicle design and performance characteristics on vehicle stability, control, handling, and driver performance.

- Application and Further Development of DASCAR (VRTC). Building of two full DASCAR (DASCAR-1) systems (in addition to the original prototype) incorporating improvements identified during testing of the prototype DASCAR-1 is envisioned in this program. Following successful testing of the DASCAR-2 prototype, additional DASCAR-2 systems (number to be determined) will be built, if necessary. A DASCAR-1 system will be used to collect a shorter-term in situ driver performance and behavior data. Methods for collecting and analyzing large quantities of in situ driver performance and behavior data will be developed under this program.

- **Relationship Between Headlight Glare and Driving Performance (DTNH22-94-**X-07349). To obtain data on the effects of headlight glare on driving performance to serve as a baseline for judging advanced technology benefits and to provide an objective basis for harmonized low beam photometrics.

- **Assessment of Advanced Nighttime Glare Reduction and Illumination Enhancement Technologies (DTNH22-**94-X-07274). To assess new technologies and techniques for reducing headlight glare, such as polarization, smart headlights, and electro-optic devices.

- **Effects of Long-Term Familiarity on Effectiveness of Side Collision Avoidance Systems (SCAS), Phase I (VRTC) (DTNH22-94-Y-07016).** Determination of the effectiveness of Side CAS. NHTSA needs to know how effective Side CAS are at preventing lane change/merge accidents after drivers are accustomed to using Side CAS. NHTSA needs to be particularly concerned about two possible cases. One is that drivers may stop using/ignore the CAS, making it ineffective at reducing accidents. The second is that drivers may over-rely on the CAS and ignore their mirrors. If the CAS hardware is not completely reliable, this could degrade safety.

- **Prototype Heavy Vehicle Drowsy Driver Detection System (DTNH22-93-D-0700/TO#4)** Integrate current knowledge on drowsy driver detection/warning system sensors requirements, decision algorithms, and driver advisory/alerting signals. Develop, test, and evaluate a prototype, in-vehicle system for heavy trucks which continuously monitors the driver's alertness/drowsiness. Develop performance specifications to foster the ability of system suppliers and truck users to commercially deploy safety-effective driver drowsiness detection systems.

- **ITS Architecture Requirements and Features Needed to Provide for Safety-Related ITS User Services (DTNH22-93-D-07317/TO#2).** The ITS Architecture is the framework of interconnected subsystems which will facilitate the application of current and future technologies to improve transportation. Task Order Number 2 will verify that the ITS Architecture provides for safety-related user services.

RESEARCH ACTIVITIES COMPLETED AND TECHNOLOGICAL PROGRESS

The following is a summary of research projects, grants, contracts, and technological progress ***completed*** by NHTSA:

CRASHWORTHINESS

Biomechanics

- **Foot/Ankle Injury in Car Crashes.** Foot/ankle trauma rarely results in a fatality. However, these types of injuries are associated with societal costs and disability. In 1994-1995, a study was made of the response of the Hybrid III dummy in various full scale crash configurations. The maximum axial loads through the Hybrid III dummy's feet were concurrent with the maximum acceleration of the floor pan/brake pedal suggesting that the axial loads through the feet were driven by the accelerating floor pan/brake pedal. These findings were reported at the 1995 International Research Council on the Biomechanics of Impact (IRCOBI) Conference.

- **Combined Air Bag and Belt Restraints.** The combined air bag and 3-point belt have become standard restraint systems in new vehicles. The problem is that the two separate restraint systems do not cooperate to correctly load the human torso. A study found, in sled tests, that the shoulder belt takes most of the load. This lack of cooperation is critical to our older driving population whose ribs fracture far more easily than for the young. In 1994-1995, an experimental study showed that combining an air bag system with a shoulder belt force-limited to 4 kilonewtons greatly reduces the trauma observed in older human cadavers. These findings were reported at the 1995 Stapp Car Crash Conference.

- **Reducing Foot/Ankle Trauma.** In real world accident counts of injuries, lower extremity trauma ranks number two and ankle/foot injuries have the highest count among lower extremity injuries. In 1995 occupant simulations were conducted and suggested that a 2.5-cm thickness of suitable floor padding can reduce the axial loads through the feet by a third. The study then demonstrated in laboratory tests that a small thickness of padding can reduce foot/ankle trauma. It was found that a stiff padding thickness of 2.5 cm can cut the axial load (that goes through the lower leg) of the Hybrid III dummy by a half. These findings were reported at the 1995 International Conference on Pelvic and Lower Extremity Injuries.

- **Foot/Ankle of the Hybrid III Dummy.** The Hybrid III foot/ankle design has been criticized by domestic and international automakers as not human like. Biomechanics worked closely with other agency engineers to determine better design specifications for the Hybrid III dummy. Design specifications were developed to make the dummy's foot and ankle more closely approximate the performance of the human foot and ankle.

- **Analysis of Head Injury Potential Using Dummy Data.** A demonstration of the application of tools, developed at NHTSA, to assess head injury was successfully conducted. A technique for utilizing dummy-measured data as input to a computational model of the human brain was used to evaluate head injury potential occurring in crash tests conducted by NHTSA. A paper was presented at the 39th Stapp Car Crash Conference. This method of analysis is currently being applied to a broader range of crash data available at NHTSA.

- **Proceedings of the NHTSA International Symposium on Head Injury Research.** NHTSA's International Symposium on Head Injury Research resulted in the publication of 28 papers presented on several areas of neurotrauma research related to motor vehicle safety.

The presentations were nearly equally balanced between the medical and the engineering science communities. The papers were technically reviewed and edited into a hard bound proceedings volume titled ***Traumatic*** Brain ***Injury: Bioscience and Mechanics.***

- **International Research Council for the Study of Whiplash Biomechanics. An** international group of researchers and medical practitioners active in the study of whiplash injuries has been assembled. This group will review current knowledge on whiplash injury mechanisms, and will determine and coordinate future research needs.

- **Thoracic Injury Model.** An improved analytical model of the human thorax has been developed to investigate the interaction between occupants and various combinations of safety belt and air bag restraint systems. Improvements include the addition of the shoulder anatomy to better represent the loads applied by the 3-point torso belt.

- **Hip and Knee Injury Model.** A preliminary model of the pelvis and lower extremities has been developed to study hip and knee injuries. This work was presented at the International Conference on Pelvic and Lower Extremity Injuries.

- **International Conference on Pelvic and Lower Extremity Injuries.** The agency organized an international conference on pelvic and lower extremity injury research that was held in Washington, DC. The speakers from the United States, Germany, France, the United Kingdom, Sweden, Italy, Australia, and Japan presented the latest results in pelvic and lower extremity research. The proceedings will be published in the Journal ***of Crash-worthiness*** and in a hardbound volume. After the conference, the agency received comments expressing support of the opportunity to carry out a dialog across disciplines--particularly between physicians and engineers, and between researchers and practitioners.

CRASH AVOIDANCE

- **Evaluation of the Safety Impact of the TravTek Operational Test in Orlando, Florida (DTNH22-91-X-07332).** Travtek was a comprehensive ITS project that provides in-vehicle routing and tourist information to drivers. The evaluation of the safety impact of the TravTek route-guidance and navigation'project was part of the overall evaluation of the project. Data was collected from drivers who are unfamiliar with the Orlando area, as well as drivers who live in the area. Final reports have been completed and published by FHWA.

- **Vehicle Feedback Cues and Driver Performance (DTNH-22-92-D-07003/ TO#3).** This preliminary study examined the potential for feedback cues from the vehicle to the driver to influence the driver's control responses (e.g., magnitudes and frequencies of steering and/or braking control inputs) and the possible relationship of these cues to safety. The project developed recommendations for follow-on work regarding the need to develop evaluation protocols and performance specifications that affect the various feedback cues that drivers use to control the vehicle. These recommen-dations are detailed in the project final report.

- **Heavy Vehicle Driver Workload Assessment (DTNH22-91-C-07003).** This program developed a standardized workload evaluation protocol to evaluate the impact of advanced electronic systems (e.g., navigation, messaging, and communications systems) on the safe operation of heavy vehicles. Detailed on the application of the protocol and results of on-the-road data collection are provided in a final report. Follow-on research will apply the protocol to automobiles, also within the context of advanced electronic system and their impact on driver performance.

- **Longer Combination-unit Vehicles (LCV) Operational Field Tests (DTNH22-92-D-07003).** The field tests of LCVs as directed by Congress in ISTEA were completed. Five Pacific Northwest

fleets allowed antilock braking systems and special hitching mechanisms (double drawbar dollies) to be installed on 17 double and triple combinations. The evaluation period was 1 year. A report of these findings will be sent to Congress next year.

- **A Bridging Analysis for Estimating the Benefits of Active Safety Technologies (DTNH22-93-D- 07000/TO#1).** This was a preliminary assessment of alternative approaches to the development of relationships between the number of "near-misses or "close-calls" and the number of collisions. A report has been completed.

- **Assessment of Biological Effects from Electromagnetic Radiation (EMR) in the Microwave and Infrared Regions (DTNH22-93-D-07007/TO#2).** This project conducted an assessment of technical literature and studies of skin tissue which pertain to adverse health effects from human exposure to microwave and infrared EMR, including a detailed review of existing safety standards and guidelines. A report has been completed.

- **Support for the Safety Initiatives of ITS America (DTFH61-91-C-00034).** This undertaking continues to be funded by the Federal Highway Administration Intelligent Transportation System Joint Program Office.

- **Integration of ITS Electronics with Other In-Vehicle (DTNH22-93-D-07317/ TO#1).** A study was completed of potential impediments to the integration of intelligent collision avoidance systems with other in-vehicle electronics systems. A report has been completed.

- **Assessing Potential Health Hazards from Wide-Spread Use of Anticollision Devices Using ITS Technologies (DTN-H22-93-Y-07301).** An evaluation was conducted of potential health hazards from widespread usage of collision avoidance devices which use active sensors. A report is currently under review by the agency

- **Develop Crash Avoidance Research Driving Simulation Scenarios (NRD-01-3-07360/CPO#3).** The driving scenarios that were developed have been used to evaluate in-vehicle warning systems to help prevent rear-end and roadway departure crashes. A scenario authoring program was developed for generating scenarios when needed in future simulator research.

- **ABS Field data Collection (DTNH22-92-D-09002/TO #2).** This effort was designed to provide insight into the relationship between the availability of ABS brakes and driver performance and expectation. Data collection included an examination of past research, the investigation of ABS- related crashes, and the evaluation of the first-hand experience of law enforcement personnel and experts in the field. Results of this evaluation have been detailed in a final report.

EVALUATION OF TECHNOLOGICAL PROGRESS

Evaluation of Technological Progress. NHTSA continually reviews existing and proposed Federal Motor Vehicle Safety Standards and other programs in light of current circumstances and motor vehicle safety requirements. Since antilock brake systems (ABS) have become standard or optional equipment on a large percentage of passenger cars, it is evaluating the effectiveness of the existing ABS system in current cars. The objective of ABS is to improve a driver's handling and control of the vehicle during braking. The statistical analysis of the initial years of exposure of the first groups of cars equipped with ABS showed mixed results. Involvements in multivehicle crashes on wet roads and fatal collisions with pedestrians and bicyclists were significantly reduced with ABS. However, the reductions were offset by a statistically significant increase in the frequency of single vehicle, run-off-road crashes (rollovers or impacts with fixed objects), as compared to cars without ABS.

ENFORCEMENT ACTIONS, JUDICIAL DECISIONS, SETTLEMENTS, OR PENDING LITIGATION

The following is a list of the litigated cases in which NHTSA's Office of the Chief Counsel participated in 1996. At the close of the year, one of these cases was still pending.

NATIONAL TRAFFIC AND MOTOR VEHICLE SAFETY ACT

Simms v. NHTSA, 6th Circuit, Nos. 93-3239 and 934087. NHTSA issued a final rule on January 12, 1993, establishing occupant restraint requirements for seats occupied by handicapped children in school buses, pursuant to an agreement between the parties in an action seeking declaratory and injunctive relief concerning school bus seating requirements for handicapped students (FMVSS No. 222) and Department of Transportation regulations for processing complaints under section 504 of the Rehabilitation Act of 1973. On March 15, 1993, a petition for review of the Final Rule was filed in the United States Court of Appeals for the Sixth Circuit. On October 4, 1993, a petition for review of NHTSA's September 3, 1993, denial of an administrative petition for reconsideration of the Final Rule was filed, also with the Sixth Circuit. The court consolidated the two petitions for review. After the parties filed their briefs, the court held oral argument on November 9, 1994. On January 19, 1995, the Sixth Circuit entered an order denying the petition for review.

Washington v. Peña and NHTSA, 19th Cir., No. 95-9513. On March 23, 1995, a petition was filed in the United States Court of Appeals for the Tenth Circuit seeking review of a final rule published by NHTSA to amend FMVSS No. 121, "Air Brake Systems." The final rule, published on March 10, 1995, requires heavy vehicles to be equipped with an antilock brake system (ABS). The Government filed a Motion to Stay Proceedings Pending Agency Reconsideration on May 10, 1995. On June 14, 1995, the court denied the motion to stay as well as a petition to enjoin NHTSA from further proceedings on the rule. The parties filed their briefs and designated portions of the administrative record were filed with the court in response to a court order entered on September 12, 1995. At the end of 1995, the parties were awaiting a decision by the court.

MOTOR VEHICLE INFORMATION AND COST SAVINGS ACT

Competitive Enterprise Institute v. NHTSA, D.C. Circuit No. 89-1422, 93-1210. On January 15, 1993, NHTSA decided for a second time to terminate the rulemaking it had begun to consider amending the MY 1990 passenger car CAFE standard. The decision was made in response to a February 19, 1992, ruling by the United States Court of Appeals for the District of Columbia Circuit holding that NHTSA had not adequately considered motor vehicle safety in its initial decision to terminate the rulemaking. A petition for review of the second decision to terminate the rulemaking was filed on March 15, 1993. During 1994, the parties filed their briefs, and the court held oral argument on May 16, 1994. On February 3, 1995, the court entered a unanimous decision dismissing the petition for review and upholding the agency's decision not to amend the standard. Petitions for rehearing and for rehearing *en banc* were filed on March 20, 1995. After the Government filed its response, the court issued orders denying rehearing and rehearing *en banc* on May 17, 1995.

CONSUMER ACTIVITIES

AUTO SAFETY HOTLINE

The Auto Safety Hotline is the Single Point of Contact for all of NHTSA. Consumers can use this toll- free number to report safety-related defects, request information on various safety-related recalls, and request a variety of other motor vehicle safety literature. The number (800-424-9393 or 202-366-0123 within the Washington D.C. area) is accessible in all 50 states, Puerto Rico, and the Virgin Islands. The TDD number for the deaf is 800-424-9153 or 202-366-7800 within the Washington, D.C. area. Calls are answered 24 hours a day, 7 days a week. Representatives are available between 8 a.m. and 10 p.m. eastern time, Monday through Friday. Two Spanish-speaking representatives are available between 8 a.m. and 10 p.m. eastern time, Monday through Friday. The Hotline's most popular reports on child safety seats, uniform tire quality grading, and the New Car Assessment Program are available by fax.

WEB SITE

On October 1, the agency established a home page to make information and publications available to the public over the Internet. Included on the site are press releases, announcements of meetings, crash test results, recall data, accident and fatality statistics, literature on safety campaigns, and emergency medical services information. By the end of the year, the volume of accesses were several thousand per week. The address is http://www.nhtsa.dot.gov.

FUEL ECONOMY

NHTSA issued a proposal to set the fuel economy standard for light trucks at 20.7 miles per gallon (mpg) for MY 1998.

MOTOR VEHICLE DOMESTIC CONTENT LABELING

NHTSA modified its rule requiring light duty vehicles to be labeled with details of the country of origin of their parts. This modification will both reduce the content calculation burden for suppliers and increase the accuracy of the information provided to the public on the labels.

UNIFORM TIRE QUALITY GRADING STANDARDS

NHTSA currently requires passenger car tires to be graded with information on the tire's traction, treadwear, and temperature resistance. In 1995, the agency proposed to change the requirements for its tire grading standards to (1) improve the repeatability of treadwear grades, (2) recognize tires with superior traction capabilities, and (3) grade tires for rolling resistance because lower rolling resistance results in lower fuel consumption. NHTSA followed up its proposal with a public meeting on tire grading standards. However, the Department of Transportation's fiscal year 1996 appropriations forbids NHTSA from working on any tire grading measures other than traction, treadwear, and temperature resistance.

NEW CAR ASSESSMENT PROGRAM (NCAP)

NHTSA crash tests new cars and light trucks to provide consumers with comparative crashworthiness information to help them when shopping for a new vehicle. Frontal crash test results were released that apply to 91 MY 1995 vehicles. (These results are included in Appendix B.)

In response to Congressional directives, NHTSA has intensified its efforts to make NCAP information available to new vehicle buyers. The agency developed a brochure in cooperation with the Federal Trade Commission and the American Automobile Association which includes automobile safety features, NCAP crash test results, and theft ratings. More than 360,000 brochures were distributed through the Consumer Information

Center in Pueblo, Colorado, NHTSA's Auto Safety Hotline, and AAA clubs around the nation.

Other activities to promote NCAP included setting up a FAX system that allows consumers to obtain crash test results over their FAX when they call the Auto Safety Hotline, the development of a print media campaign to promote NCAP, and the creation of an exhibit on NCAP. The print media campaign included a series of public service announcements that were sent to and used by daily and weekly newspapers and other specialized publications around the country. More than 250 publications, with a total circulation of more than 10 million readers, ran these public service announcements. The NCAP exhibit is on loan to the Petersen Automotive Museum in Los Angeles, California. The exhibit was officially opened by Secretary Peña in a September 1995, kickoff at the museum. One of the features of the exhibit is a direct connection to the Auto Safety Hotline in Washington, D.C. that consumers can use to request NCAP test results. A cd-rom to accompany this exhibit has also been developed.

THEFT PREVENTION ACT

Based on information supplied by manufacturers, NHTSA determines whether vehicles for sale in the United States should be classified as likely high or low theft. For MYs 1987-1997, 232 car lines were determined as likely high-theft lines. Designated major component parts of these vehicles must be marked with the vehicle identification number unless the manufacturer obtains an exemption from marking them from the agency because the vehicle(s) has an agency-approved antitheft device installed as standard equipment on the entire line of vehicles.

The Anti-Car Theft Act of 1992 provides that, beginning with the 1997 model year, multipurpose passenger vehicles and light duty trucks must comply with the marking requirements of the theft prevention standard. Passenger cars have been subject to those marking requirements since the 1987 model year. As required by the Act, a new median theft rate was established for all passenger motor vehicles (passenger cars, multipurpose passenger vehicles, and light duty trucks) that are rated at 6,000 pounds gross vehicle weight or less. Those vehicles that are ranked above the median are subject to the parts-marking requirements of the standard.

OTHER INFORMATION ACTIVITIES

NHTSA issued news releases on its activities and conducted news conferences to explain agency priorities and receive informal feedback from those interested in the agency's activities.

AD COUNCIL CAMPAIGN

NHTSA's two national media campaigns, under the auspices of the Ad Council, continued to inform consumers about the importance of safety belt use and prevention of drunk driving.

TITLE I: BUMPER STANDARD

Title I of the Motor Vehicle Information and Cost Savings Act charges NHTSA to formulate a bumper standard that seeks to obtain the maximum feasible reduction of costs to the public and consumers.

NHTSA has established requirements for the impact resistance of passenger car bumpers in low-speed front and rear collisions. The bumper standard was reduced from 5 mph to 2.5 mph in 1982, based on extensive analysis of the costs and benefits of 5 mph bumpers, and on a comprehensive rulemaking record. The level was set by the agency to maximize net consumer benefits after taking into account the protection offered by bumpers, the higher costs to all consumers of obtaining that protection, and the frequency of low-speed crashes. Nevertheless, most automobile manufacturers are providing 5-mph bumpers on at least some of their vehicles in response to perceived consumer demand.

GLOSSARY OF ACRONYMS

ABS	Antilock Braking System
ACN	Automatic Collision Notification
ARPA	Advanced Research Projects Agency
CAFE	Corporate Average Fuel Economy
DASCAR	Data Acquisition System for Crash Avoidance Research
EMR	Electromagnetic Radiation
EPA	Environmental Protection Agency
FARS	Fatal Accident Reporting System
FHWA	Federal Highway Administration
FMVSS	Federal Motor Vehicle Safety Standard
FOCAS	Forward Crash Avoidance Systems
GES	General Estimates System
GPRA	Government Performance and Results Act
ICC	Intelligent Cruise Control
IROBI	International Research Council on the Biomechanics of Impact
ISTEA	Intermodal Surface Transportation Efficiency Act
ITS	Intelligent Transportation System
IVHS	Intelligent Vehicle/Highway System
LCV	Longer Combination-unit Vehicles
MY	Model Year
NADS	National Advanced Driving Simulator
NASS	National Accident Sampling System
NCAP	New Car Assessment Program
NCSA	National Center for Statistics and Analysis
NHTSA	National Highway Traffic Safety Administration
NPR	National Performance Review
OMB	Office of Management and Budget
SAE	Society of Automotive Engineers
SEP	Strategic Execution Plan
TDD	Telecommunications Device for the Deaf
UMTRI	University of Michigan Transportation Research Institute
VRTC	Vehicle Research and Test Center

APPENDIX A

PUBLICATIONS OF THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION

Nearly 6 million educational and technical materials were distributed to the public during 1995 by the TSP Resource Center. The following is a representative sample of those materials.

OCCUPANT PROTECTION

"Child Restraints and Automobiles: At Times an Uneasy Union" (Video)

"Look Beyond the Obvious" (Poster)

"Car Seat Safety Why? When? What? Where? How?" (Brochure)

"Are You Using It Right?" (Brochure)

"Vince and Larry@ on Belts and Bags" (Brochure)

"One Minute Safety Checkup" (Information Sheet)

"Shopping Guide to Child and Infant Safety Seats" (Information Sheet)

"Entry Form National Safety Belt Honor Roll" (Booklet)

"Vince and Larry@: "Why Go Through This?" (Poster)

"Sudden Impact: An Occupant Protection Fact Book" (Booklet)

"Which of these Children Should Be In A Car Seat?" (Poster)

"Not Wearing a Seat Belt Can Be Murder On Your Clothes" (Poster)

"A Few Seconds to Buckle Up and He Could Have Finished the Season" (Poster)

"Vince and Larry@: Want to Keep Your Face From Breaking Out?" (Poster, Book Jacket)

"Take Vince and Larry's@ Crash Course on Child Safety Seats" (Brochure)

"Buckle Up Kids: Fire and Rescue Child Passenger Safety Program -- Participant's Training Manual" (Course Manual)

"Vince and Larry@>" 28 Spots (PSAs)

"Youth Traffic Safety" Public Service Announcements (PSAs)

"Vince and Larry@ 'Breaking Up Isn't Hard to Do.' Buckle Your Safety Belt." (Bumper Sticker)

"We Love You-Buckle Up!" (Sticker)

"Seat Belt Patrol Sticker"

IMPAIRED DRIVING

"Enforcement Of Underage Impaired-Driving Laws" (Report)

"Digest of State Alcohol Highway Safety Related Legislation" (13th Edition)

"Traffic Safety Facts 1994" (Alcohol) (Fact Sheets)

"3D Prevention Month Program Planner" (Kit)

"Three Ways to Keep a Friend...Alive" (Brochure)

"Drive Aware We're Out There (Ride Smart Campaign)" [Brochure]

"Guide for Detecting Drunk Drivers at Night" (Brochure)

"Join the Celebration" (Booklet)

"Questions Most Frequently Asked About Administrative License Revocation" (Brochure)

"Yo! Don't Abuse Life, Choose Life! Stay Away from Drugs and Alcohol" (Poster)

"Safe Driving Practices" (Flyer)

"Card Tricks (How to Spot Fake ID Cards)" [Brochure]

"Impaired Perspectives: Alcohol on America's Highways" (Brochure)

".08 BAC Limit Saves Lives: Why Every State Needs a .08 BAC Law" (Brochure)

"Lights On For Life December 15" (Poster)

"3D: December is National Drunk and Drugged Driving Prevention Month" (Button)

"Partners in Progress: National Impaired Driving Goals and Strategies for 2005" (Report)

EMERGENCY MEDICAL AND POLICE TRAFFIC SERVICES

"National Standard Curriculum for Bystander Care" (Manual)

"Make the Right Call Campaign" (Kit)

"Star of Life Emergency Care Symbol" (Booklet)

"Traffic Enforcement: Saving Lives and Combating Crime" (Booklet)

"Speed Shatters Life" (Folder)

"IACP National Law Enforcement Saved by the Belt/Air Bag Awards Program" (Sheet)

"STEP (Selective Traffic Enforcement Program)" [Manual]

"Yo! No Need for Speed!" (Poster)

"Saturation Patrols Targeting Impaired Driving for Municipal Police: Guidelines" (Manual)

"Law Enforcement Public Information: A Guide for Law Enforcement Administrators" (Manual)

"Speed and Stopping Distances" (Flyer)

"Model Minimum Performance Standards for Lidar Speed Measurement Devices" (Report)

BICYCLE, MOTORCYCLE, PEDESTRIAN, SCHOOLBUS SAFETY

"School Bus Safety Report"

"Bicycle Safety Message To Parents, Teachers and Motorists" (Sheet)

"Don't Get Towed. Get Licensed. The Risk of Unlicensed Riding." (Clip Art)

"Before Your Child Gets on a Motorcycle" (Brochure)

"Choosing a Helmet" (Brochure)

"'Cruisin' Without Bruisin'" (Brochure)

"Prevent Pedestrian Accidents: Myths and Facts About Pedestrian Safety" (Fact Sheet)

"Prevent Bicycle Accidents" (Fact Sheet)

"Everyone Is a Pedestrian" (Flyer)

"Motorcycle Helmets -- The Facts of Life" (Brochure)

"Motorcycle Safety" (Booklet)

"Along for the Ride -- Safety Tips for Cyclists" (Brochure)

"10 Smart Routes to Bicycle Safety" (Booklet)

"Don't Get Towed, Get Licensed" (Flyer)

"Pedestrian Safety Tips: 1 - 15" (Flyers)

SPANISH LANGUAGE MATERIALS

"It's Your Decision...Go With Caution!" (Poster)

"Vince and Larry@" Spanish PSAs

"How to Make Your Child's World a Safer Place" (Sheet)

"Safetyville" (Poster)

"Welcome to Safetyville" (Coloring Book)

"COSSMHO Spanish-Language Safety Kit"

"COSSMHO Spanish-Language Drunk Driving" (Brochure)

"COSSMHO Spanish-Language Pedestrians" (Brochure)

"COSSMHO Spanish-Language Seat Belts" (Brochure)

"COSSMHO Spanish-Language Child Passenger Safety" (Brochure)

MISCELLANEOUS

"Auto Safety Hotline" (Brochure)

"Highway Grant Program: Section 402 State & Community Highway Safety" (Brochure)

"Campaign Safe and Sober Quarterly Planners" (Various planners cover topics of: alcohol, child passenger safety, youth and speed) (Kit)

"Putting It Together: A Model for Integrating Injury Control Systems Elements (Summary) [Booklet]

"Campaign Safe and Sober" (Button)

"With ABS Don't Let Up!" (Antilock Brake Systems) [Flyer]

"Commitment, Communication Cooperation: Traffic Safety and Public Health Working Together to Prevent Traffic Injury" (Manual)

"Motor Vehicle Injury Prevention: An Assessment of Highway Safety and Public Health Activities in Selected States" (Report)

"The Cost of Injuries to Employers" (Report)

APPENDIX B

NEW CAR ASSESSMENT PROGRAM RESULTS FOR 1996

How To Use This Chart

Vehicles should be compared against other vehicles in the same weight class. If a light vehicle collides head-on with a heavier vehicle at 35 mph, the occupants in the lighter vehicle could experience a greater chance of injury than the results of this test indicate.

Vehicles are classified by the estimated chance of life threatening head and chest injury for the driver or passenger and receive a one to five star rating, with five stars ★ ★ ★ ★ ★ indicating the best head and chest protection.

Thigh injury, although rarely life threatening, is also measured in the tests. Such injury can be disabling and, if a high likelihood of thigh injury occurs in the tests, it is indicated in the charts by an asterisk (*).

1996 MINI PASSENGER CARS
(1600 - 1999 lbs. Curb Weight)

TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
GEO METRO 4-DR. SEDAN	1986 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★	✓	

* HYBRID II DUMMY

1996 LIGHT PASSENGER CARS
(2000 - 2499 lbs. Curb Weight)

TEST RESULTS BASED ON 36 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
FORD ASPIRE	2086 lbs.	DRIVER	★★★★	✓	
4-DR. HB		PASSENGER	★★★★	✓	
HONDA CMC	2317 lbs.	DRIVER	★★★	✓	
4DR. SEDAN		PASSENGER	★★★	✓	
HONDA CMC COUPE	2498 lbs.	DRIVER*	★★★	✓	
2-DR.		PASSENGER*	★★★★	✓	
HYUNDAI SCOUPE	2201 lbs.	DRIVER*	★★★★	✓	✓
2-DR.		PASSENGER*	★★★★		✓
KIA SEPHIA	2456 lbs.	DRIVER*	★★★		✓
4-DR. SEDAN		PASSENGER*	★★★★		✓
MAZDA PROTEGE	2429 lbs.	DRIVER	★★★	✓	
4DR. SEDAN		PASSENGER	NO DATA	✓	
PLYMOUTH NEON	2391 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
SATURN SL2	2332 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
TOYOTA TERCEL	2176 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	

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1995 COMPACT PASSENGER CARS
(2500 - 2999 Ibs. Curb Weight)

TEST RESULTS BASED ON *35 MPH FRONTAL CRASH*			RATING	BELTS & AIR BAG	BELTS
ACURA INTEGRA	2709 Ibs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
CHEVROLET CAVALIER	2731 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
CHEVROLET CORSICA		DRIVER	★★★	✓	
4-DR. SEDAN	*2741* lbs.				
		PASSENGER	★★		✓
DODGE AVENGER	2952 Ibs.	DRIVER	★★★★★	✓	
2-DR.		PASSENGER	★★★★★	✓	
DODGE SPIRIT	*2846* lbs.	DRIVER	★★★★	✓	
4DR. SEDAN		PASSENGER	★★★		✓
FORD ESCORT	2509 Ibs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
FORD PROBE	*2773* lbs.	DRIVER	★★★★★	✓	
2-DR.		PASSENGER	★★★★	✓	
HONDA ACCORD	2901 Ibs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
HYUNDAI ELANTRA	*2605* lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★		✓
HYUNDAI SONATA	2761 lbs.	DRIVER	★★★	✓	
4DR. SEDAN		PASSENGER	★★★★	✓	
MAZDA 626	*2762* Ibs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★★	✓	
MITSUBISHI ECLIPSE	*2853* lbs.	DRIVER	★★★★	✓	
2-DR.		PASSENGER	★★★★	✓	

* HYBRID II DUMMY

1996 COMPACT PASSENGER CARS
(2500 - 2999 lbs. Curb Weight)

TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
MITSUBISHI GALANT	**2832** lbs.	DRIVER	NO DATA	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
NISSAN 240 SX	**2765** lbs.	DRIVER	★★★	✓	
2-DR.		PASSENGER	★★★★	✓	
NISSAN MAXIMA	2970 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
OLDSMOBILE ACHIEVA	**2806** lbs.	DRIVER	★★★★	✓	
2-DR.		PASSENGER	★★★		✓
SUBARU LEGACY	**2654** lbs.	DRIVER	★★★★	✓	
4DR. SEDAN		PASSENGER	★★★★	✓	
TOYOTA COROLLA	**2553** lbs.	DRIVER	★★★★	✓	
4DR. SEDAN		PASSENGER	★★★★	✓	
VOLKSWAGEN JETTA III	**2725** lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	

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1996 MEDIUM PASSENGER CARS
(3000 - 3499 lbs. Curb Weight)

TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
AUDI A6	3373 lbs.	DRIVER	★★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★★	✓	
BMW 325i	3234 lbs.	DRIVER	★★★★	✓	
4DR. SEDAN		PASSENGER	★★★★	✓	
BUICK CENTURY	3049 lbs.	DRIVER	★★★★	✓	
4DR. SEDAN		PASSENGER	★★★★		✓
CHEVROLET CAMARO	3408 lbs.	DRIVER	★★★★★	✓	
2-DR. HB.		PASSENGER	★★★★★	✓	
CHEVROLET LUMINA	3344 Ibs.	DRIVER	★★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★		✓
CHEVROLET MONTE	3284 Ibs.	DRIVER	★★★★	✓	
CARLO 2-DR.		PASSENGER	★★★★	✓	
DODGE INTREPID	3254 Ibs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
DODGE STRATUS	3144 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	NO DATA	✓	
FORD CONTOUR	3020 lbs.	DRIVER	★★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
FORD MUSTANG	3119 lbs.	DRIVER	★★★★	✓	
2-DR.		PASSENGER	★★★★	✓	
FORD TAURUS	3256 Ibs.	DRIVER"	★★★★	✓	
4DR. SEDAN		PASSENGER*	★★★★	✓	
FORD THUNDERBIRD	3460 lbs.	DRIVER	★★★★★	✓	
2-DR.		PASSENGER	★★★★★	✓	

* HYBRID II DUMMY

1995 MEDIUM PASSENGER CARS
(3000 - 3499 lbs. Curb Weight)

TEST RESULTS BASED ON *35* MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
HONDA ODYSSEY	8459 lbs.	DRIVER	★★★★	✓	
4-DR. WAGON		PASSENGER	★★★★	✓	
MAZDA MILLENIA	***3150*** lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★★	✓	
MERCEDES-BENZ C220	3190lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
PONTIAC GRAND PRIX	3210 lbs.	DRIVER	★★★★	✓	
2-DR.		PASSENGER	★★★	✓	
SAAB 900	***3064*** lbs.	DRIVER	★★★★	✓	
4-DR. HB		PASSENGER	★★★★	✓	
TOYOTA CAMRY	3128 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
VOLKSWAGEN PASSAT	3124 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
VOLVO 850	32411bs.	DRIVER	★★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	

* HYBRID II DUMMY

1996 HEAVY PASSENGER CARS
(3600 lbs. & over Curb Weight)

TEST RESULTS BASED ON 36 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
ACURA LEGEND	3550 lbs.	DRIVER*	★★★	✓	
4-DR. SEDAN		PASSENGER*	★★★★	✓	
CHEVROLET CAPRICE	4177 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★	✓	
CHRYSLER NEW YORKER	3589 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
FORD CROWN VICTORIA	3856 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★★	✓	
INFINITI J30	3640 lbs.	DRIVER	★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★★	✓	
LEXUS GS300	3765 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
LINCOLN TOWN CAR	4080 lbs.	DRIVER"	★★★★★	✓	
4-DR. SEDAN		PASSENGER*	NO DATA	✓	
OLDSMOBILE AURORA	3993 lbs.	DRIVER	★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	
PONTIAC BONNEVILLE	3558 lbs.	DRIVER	★★★★★	✓	
4-DR. SEDAN		PASSENGER	★★★	✓	

* HYBRID II DUMMY

1996 SPORT UTILITY VEHICLES					
TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
CHEVROLET S-10 BLAZER 4-DR. 4x4	4156 lbs.	DRIVER	★★★	✓	
		PASSENGER	★		✓
FORD BRONCO 2-DR. 4x4	4783 lbs.	DRIVER	★★★★★		✓
		PASSENGER*	★★★★★		✓
FORD EXPLORER 4-DR. 4x4	4242 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★	✓	
ISUZU RODEO 4-DR. 4x4	4021 lbs.	DRIVER	★★		✓
		PASSENGER	★★★		✓
ISUZU TROOPER 4-DR. 4x4	4301 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★	✓	
JEEP CHEROKEE 4-DR.	2983 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★		✓
JEEP GRAND CHEROKEE 4-DR. 4x4	3743 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★		✓
JEEP WRANGLER 2-DR. 4x4	2896 lbs.	DRIVER	★★		✓
		PASSENGER	★★★★		✓
MITSUBISHI MONTERO 4-DR. 4x4	4369 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★		✓
NISSAN PATHFINDER 4DR. 4x4	3932 lbs.	DRIVER"	★		✓
		PASSENGER*	★★★		✓
SUZUKI SIDEKICK 4-DR. 4x4	2762 lbs.	DRIVER	★★		✓
		PASSENGER	★★★		✓
TOYOTA 4RUNNER 4-DR. 4x4	4114 lbs.	DRIVER*	★		✓
		PASSENGER*	★★★★		✓

* HYBRID II DUMMY

1995 LIGHT TRUCKS

TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
CHEVROLET Cl500 PU 2-DR.	3944 lbs.	DRIVER	★★★★★	✓	
		PASSENGER	★★★★★		✓
CHEVROLET S-10 PU 2-DR.	3091 lbs.	DRIVER	★★★	✓	
		PASSENGER	★		✓
DODGE DAKOTA PU 2-DR.	3924 lbs.	DRIVER	★★★★★	✓	
		PASSENGER	★★★★		✓
DODGE RAM 1500 PU 2-DR.	4469 Ibs.	DRIVER	★★★★★	✓	
		PASSENGER	NO DATA		✓
FORD F150 PU 2-DR.	4444 lbs.	DRIVER	★★★★★	✓	
		PASSENGER*	★★★★★		✓
FORD RANGER PU 2-DR.	3245 lbs.	DRIVER	★★★★	✓	
		PASSENGER*	★★★★		✓
ISUZU PU 2-DR.	2340 lbs.	DRIVER	★★★		✓
		PASSENGER	★★★★		✓
MITSUBISHI MIGHTY MAX PU 2-DR.	2731 lbs.	DRIVER*	★★★	✓	
		PASSENGER*	★★★		✓
NISSAN PU 2-DR.	2793 lbs.	DRIVER*	★★★		✓
		PASSENGER*	★★★★		✓
TOYOTA PU 2-DR.	2563 Ibs.	DRIVER"	★★		✓
		PASSENGER*	★★★★		✓
TOYOTA T100 PU 2-DR.	3332 Ibs.	DRIVER	★★★★	✓	
		PASSENGER*	★★★★★		✓

* HYBRID II DUMMY

1995 VANS

TEST RESULTS BASED ON 35 MPH FRONTAL CRASH			RATING	BELTS & AIR BAG	BELTS
CHEVROLET BEAUVILLE SPORT VAN	5031 lbs.	DRIVER	★★★	✓	
		PASSENGER	★★★		✓
DODGE CARAVAN	3457 Ibs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★	✓	
DODGE RAM VAN 2500	4162 lbs.	DRIVER	★	✓	
		PASSENGER	★★★		✓
FORD AEROSTAR VAN	3670 lbs.	DRIVER*	★★★★	✓	
		PASSENGER*	★★★		✓
FORD ECONOLINE VAN	5166 lbs.	DRIVER*	★★★★	✓	
		PASSENGER*	★★★		✓
FORD WINDSTAR VAN	3801 lbs.	DRIVER	★★★★★	✓	
		PASSENGER	★★★★★	✓	
MAZDA MPV VAN	3794 lbs.	DRIVER	★★★★	✓	
		PASSENGER*	★★★		✓
NISSAN QUEST VAN	3855 Ibs.	DRIVER	★★★★	✓	
		PASSENGER*	★★★		✓
PONTIAC TRANS SPORT VAN	3708 lbs.	DRIVER	★★★★★	✓	
		PASSENGER	★★★		✓
TOYOTA PREVTA VAN	3644 lbs.	DRIVER	★★★★	✓	
		PASSENGER	★★★★	✓	

* HYBRID II DUMMY

DOT HS 808 475
11/96